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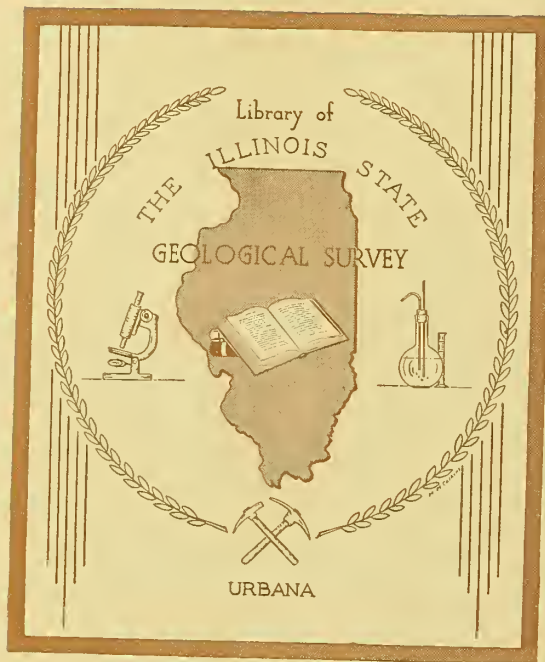
HYDROGEOLOGIC DATA
FROM FOUR LANDFILLS
IN NORTHEASTERN ILLINOIS

G. M. Hughes, R. A. Landon, and R. N. Farvolden

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ILLINOIS STATE GEOLOGICAL SURVEY

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INTRODUCTION

Methods of drilling, sampling, and analysis used in an investigation of four landfills in northeastern Illinois and the geologic and geochemical data derived from the study are presented in this report. The investigation, undertaken to determine the hydrogeologic conditions and effects of waste disposal at four sites in representative glaciated terrains, is being carried on by the Illinois State Geological Survey, the University of Illinois, and the State Department of Public Health under U. S. Department of Health, Education and Welfare Demonstration Grant No. 5-D01-01-00006-02. The contents of this note are taken from our report entitled "Hydrogeology of Solid Waste Disposal Sites in Northeastern Illinois," which we submitted to the U. S. Department of Health, Education and Welfare on July 1, 1968.

Location of the four sites is shown in figure 1. All data in the tables refer to sampling points, the locations of which are shown on maps of the DuPage County (fig. 2), Winnetka (fig. 3), Elgin (fig. 4), and Woodstock (fig. 5) landfills.

The data include piezometer and sampling points (table 1), sample description logs (table 2), sieve analyses of representative earth materials (table 3), clay mineral analyses (table 4), chemical analyses of leachate and ground water associated with the landfills, made by the State Department of Public Health (table 6) and by a commercial laboratory (table 7), and results of neutron activation analyses for selected elements (table 8).

OPERATIONS AND GEOLOGIC CONDITIONS AT THE LANDFILL SITES

Filling at the DuPage County site was started in September 1952 and completed in November 1965. The site is reported to have been operated as a sanitary landfill, although refuse was probably deposited below the top of the zone of saturation and ponds are present in wet weather on the fill surface.

The site occupies a poorly drained lowland adjacent to Kress Creek on a flat area between the Minooka Moraine on the west and the West Chicago

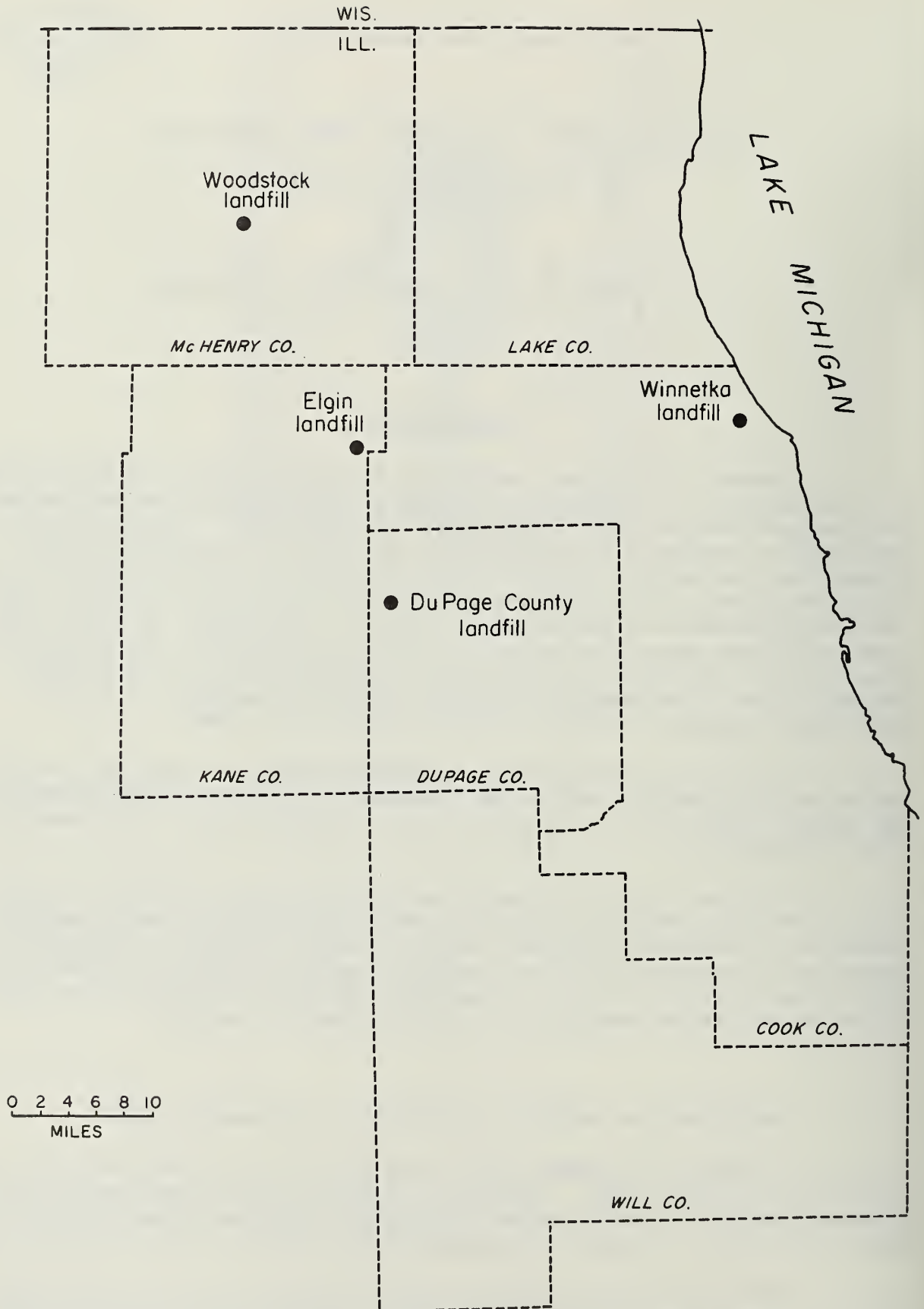


Fig. 1 - Solid waste disposal sites studied in northeastern Illinois.

Moraine on the east. The 75 feet of glacial drift under the site consists of a surficial sandy material and several tills. The sandy silt to silty sand at the surface is as much as 21 feet thick, but it thins toward the margins of the landfill. The upper till is a clayey silt till ranging from 5 to 25 feet thick. The middle, sandy silt till is 12 to approximately 20 feet thick and the eastern half of the site generally is underlain by 1½ to 5 feet of sand and fine gravel. The lower unit, a silt till, is 20 feet thick. The bedrock consists of fractured dolomite of Silurian age that is a major aquifer in the area.

Filling at the Winnetka site was begun in January 1947 and is continuing at present. The site is operated as a sanitary landfill, although refuse is deposited below the top of the zone of saturation and ponds are present in wet weather on the fill surface.

The landfill is on a flat area adjacent to the Skokie River. Several feet of soil and fill and 5 to 11 feet of sandy clay and silt alluvium form the surficial deposits. The drift is about 110 feet thick and consists mostly of silty clay tills that become more sandy and stony with depth. Sand and silt stringers 6 inches to 2 feet thick and of small lateral extent are interbedded with the till at the base of the drift. The bedrock consists of fractured dolomite of Silurian age.

Filling was begun at the Elgin site in 1948, and the site was operated as an open, burning dump until 1964, when sanitary landfilling was commenced; it is continuing. Probably no appreciable quantities of refuse have been deposited below the top of the zone of saturation, and there is little if any ponding on the fill surface.

The site is adjacent to the Fox River on the site of a former gravel pit operation. Two to 3 feet of clayey silt to sandy silt topsoil may cover the drift. The drift is about 60 feet thick and consists of 20 feet of sand and gravel (10 feet have been removed by gravel operation), nearly 40 feet of sandy silt tills, and 2 to 5 feet of basal sand and gravel. A thin layer of fractured dolomite of Silurian age forms the bedrock. Dolomite and shale of the Maquoketa Group lie beneath the Silurian dolomite and crop out immediately west of the site.

Filling at the Woodstock site was begun in 1940, and the site was operated as an open, burning dump until 1965. At that time sanitary landfilling was commenced and is continuing. In the early stages of filling, refuse was deposited below the top of the zone of saturation. Ponding occurs on the fill surface in wet weather.

The landfill occupies a swampy lowland and slope adjacent to the southern margin of the West Chicago Moraine. The southern two-thirds of the site is covered by 5 to 19 feet of peat and nonorganic silt. Several feet of silty clay soil, which becomes sandy toward the northern end of the site, may cover the peat. The thick drift consists of a surficial sand and gravel up to 19 feet thick, 245 feet of till and interbedded sand and gravel, and basal sand and gravel. The upper till is a silty clay that reaches a maximum thickness of 20 feet but thins over topographic lows. The lower tills change from sandy silt to silty sand with increasing depth. Sand and gravel deposits commonly 5 or more feet thick are interbedded with these tills. The bedrock consists of a thin layer of fractured Silurian dolomite overlying dolomite and shale of the Maquoketa Group.

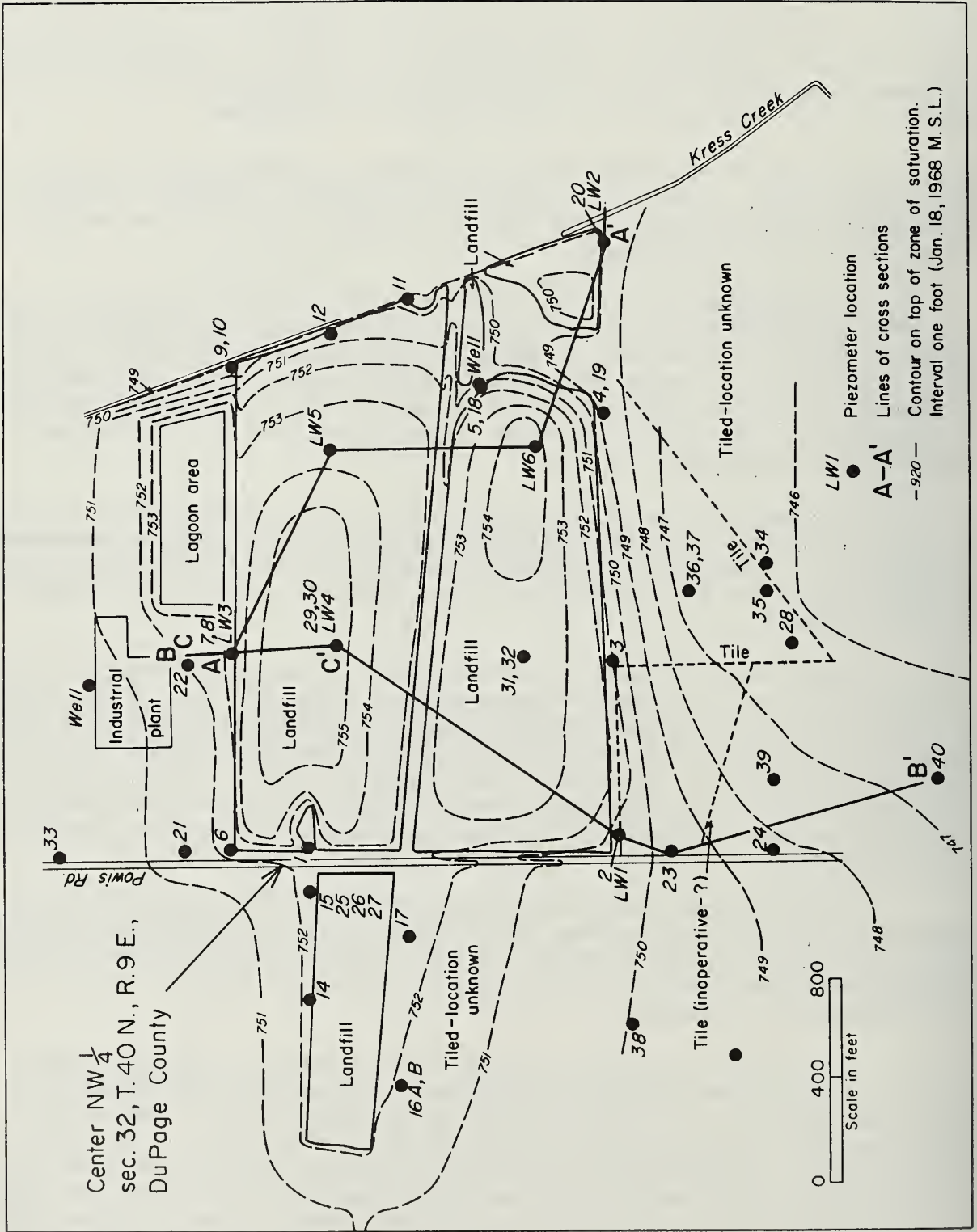


Fig. 2 - Diagram of DuPage County landfill showing locations of borings and the top of the zone of saturation. Cross sections were presented in the original report by Hughes et al.

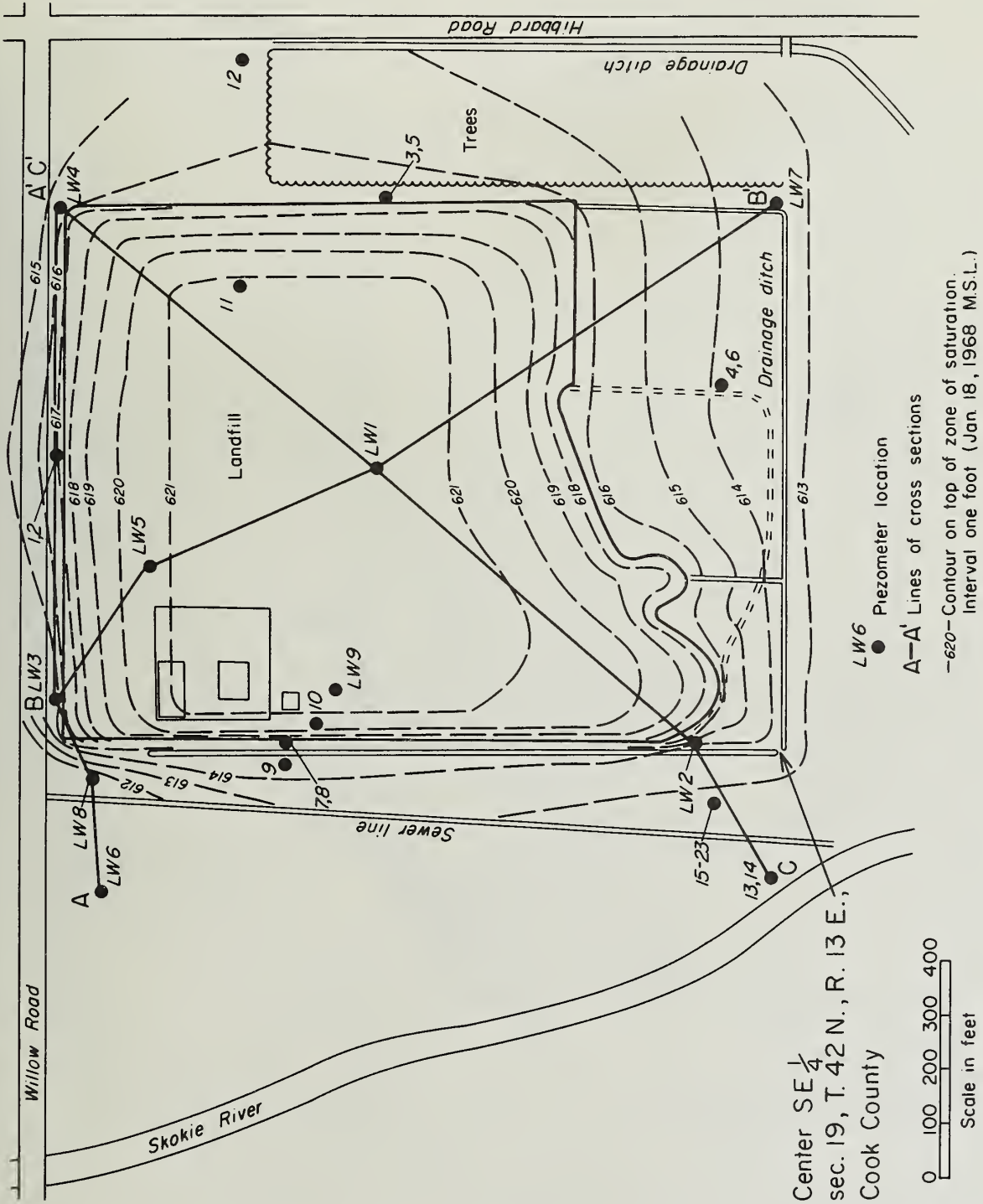
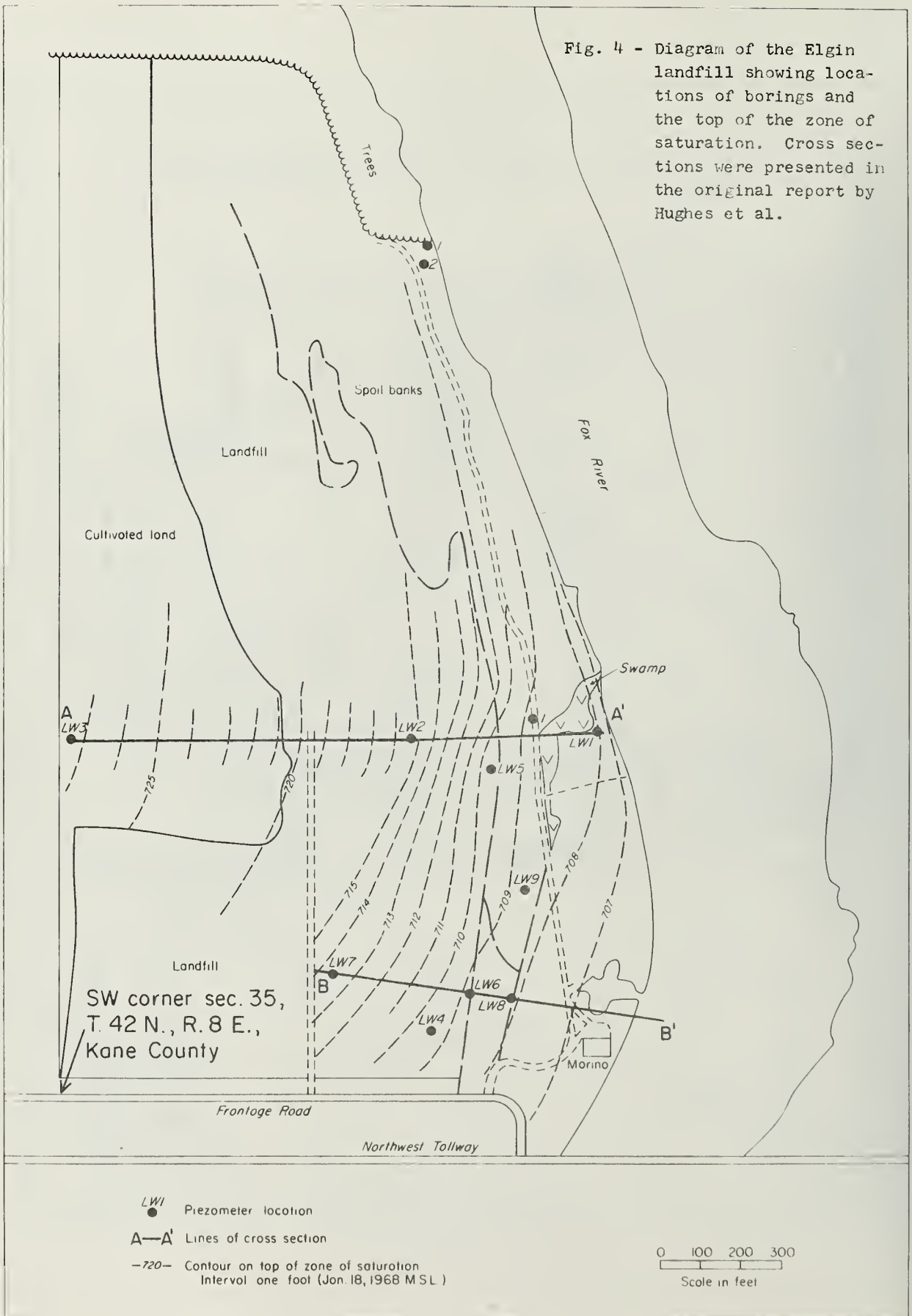


Fig. 3 - Diagram of the Winnetka landfill showing locations of borings and the top of the zone of saturation. Cross sections were presented in the original report by Hughes et al.

Fig. 4 - Diagram of the Elgin landfill showing locations of borings and the top of the zone of saturation. Cross sections were presented in the original report by Hughes et al.



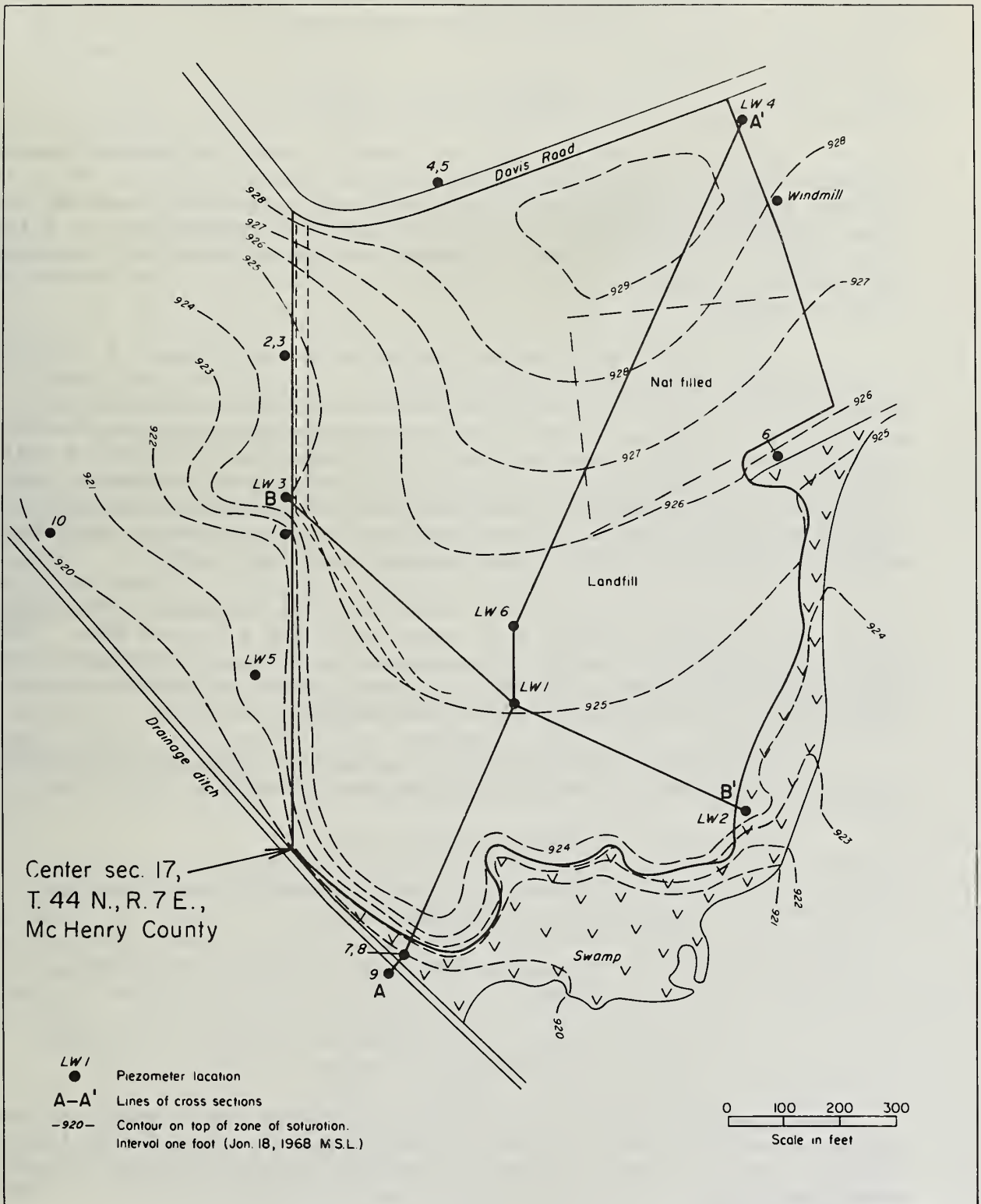


Fig. 5 - Diagram of the Woodstock landfill showing locations of borings and the top of the zone of saturation. Cross sections were presented in the original report by Hughes et al.

DRILLING, MATERIAL SAMPLING, AND PIEZOMETER AND WELL POINT INSTALLATION

Installation Procedure

Most of the drilling for the landfill investigation was done under an hourly contract with Layne-Western Company, Aurora, Illinois, but a substantial number of the shallow borings were made by project personnel with a portable Mobile Minuteman auger drill loaned by the University of Illinois Water Resources Center. A total of 3459 feet was bored and 167 piezometers and sampling points installed. Pertinent data regarding these borings are given in table 1.

The contract drilling program proceeded as follows. A rotary rig, in most cases a Franks FA 54 with bentonite or natural drilling fluid, drilling a 4 3/4-inch to 7 7/8-inch hole was used first at each site to establish the sequence of materials. Piezometers were then installed to get preliminary information on ground-water elevations. Samples of drill cuttings were collected at the mud tank and these, with information from the driller on the drilling characteristics of the materials and from a Widco electrical resistivity drill hole log, provided adequate data for the selection of points at which the piezometers were to be set.

The next series of contract borings used the hollow stem auger method and generally a Mobile B 61 auger rig boring a 10-inch hole. These holes were limited to a depth of approximately 55 feet. Split-spoon samples were taken inside these augers to get a more precise definition of the character of the materials by visual and laboratory methods.

Additional contract borings were made by using one of the above methods, and in one case the air-drilling method was used.

Three types of piezometers were used:

- 1) A 24 x 1 1/4-inch No. 10 well screen (3' total length) on 1 1/4-inch plastic pipe.
- 2) A 6 x 1 1/4-inch No. 10 suction strainer on 1 1/4-inch plastic pipe.
- 3) Porous plastic 1 1/2 x 18-inch on 3/8-inch ID (internal diameter) polyethylene tubing.

The well screen and suction strainer were set in materials considered permeable enough to produce reliable water samples for quality analyses. The plastic piezometer tip was used only in relatively impermeable materials. The suction strainer was used only in holes less than 20 feet deep.

The installation of screened piezometers in rotary borings proceeded in the following manner. After the boring was made, the screen attached to the 1 1/4-inch plastic pipe was installed in the hole at the proper

depth. If the screen were to be set above the bottom of the hole, backfill was added until a solid bottom was present at the proper depth. The bore hole was then back-flushed, through the plastic pipe and screen, until returns were relatively clear. An average of 200 gallons of water was necessary to flush a 100-foot hole. Sand* was then poured into the boring or washed down a half-inch pipe to approximately 1 foot above the screen. The latter method was most efficient. Next, a seal was installed above the sand by one of the following methods:

- 1) A bentonite slurry was pumped down a half-inch pipe in the annulus. If the slurry is too thick, backfill will not settle and subsequent piezometers will sink.
- 2) Dry bentonite pellets or granules were poured down the annulus. This method was used only in shallow borings, as the bentonite tended to bridge.
- 3) Clay cuttings and mud returns from the rotary drilling were poured down the annulus.

The hole was then backfilled with cuttings or a fill, sand, and cuttings mixture to the approximate base of the next piezometer, and the foregoing procedure was repeated. Up to six piezometers were installed in one boring. In holes subject to caving, two piezometers were hung in the hole at the same time so that if caving occurred the hole could be flushed through both piezometers.

Installations drilled by the hollow stem auger method, in which screened piezometer tips were used, were made in a similar manner except that the piezometer was installed inside the hollow stem augers. The augers were raised a little at a time to allow placement of the sand around the piezometer tip and the seal. The porous plastic piezometer tips were also installed through a hollow stem auger and dry bentonite pellets used as a seal.

In the boring made by the air-drilling method, casing was used to shut out any shallow water and the hole advanced dry to the first permeable zone below the casing. A screened piezometer was installed opposite this zone, sand was blown down around the point, and dry bentonite blown down above the sand to form a seal. Dry bentonite coats and seals the sides of the boring, making multiple installations less practical. This type of installation can be used if no appreciable quantities of water are encountered.

Borings made with the portable Mobile Minuteman power auger were generally less than 15 feet deep. Screened piezometers were installed in these borings with and without flushing. Seals were installed at land surface to prevent vertical leakage and occasionally emplaced at depth by dropping dry bentonite down the annulus of the bore hole.

* Commercially bagged silica sand (St. Peter Sandstone, with 60% and 30% retained on U. S. sieves 30 (0.589 mm) and 40 (0.417 mm) mesh, respectively) was used in most contracted borings. Local sand was used on some shallow borings.

Polyethylene tubing (3/8-inch ID) with cork mounted around one end was used to reduce the diameter of the standpipes in screened piezometers when it was found that these piezometers had been set in materials with low permeability and were not sensitive enough. The cork and tubing were inserted within the 1½-inch plastic pipe with a half-inch metal pipe to a point just above the screen. Dry bentonite was placed in the annulus between the 1½-inch plastic pipe and the 3/8-inch ID tubing after the half-inch metal pipe was removed. This method of increasing piezometer sensitivity was generally used in holes less than 20 feet deep, but it also was used in one hole 225 feet deep.

Evaluation of Installation Procedure

While the foregoing methods of installing piezometers are relatively inexpensive, it is difficult to install adequate seals between units, and these seals leaked in a number of instances. Leakage was established by adding or removing water from a suspect piezometer and noting changes in water level in adjacent piezometers in the same boring. Those units in which appreciable leakage could be established are as follows: (1) DuPage County landfill - LW 3B to surface sand; (2) Elgin landfill - between LW 4A and B; LW 5A and B; LW 7A and B; (3) Winnetka landfill - LW 1A,B,C, and D; LW 2C and D; LW 3B,C, and D; LW 4D and E; LW 7A,B, and C; LW 9A and B; (4) Woodstock landfill - LW 1B and C; LW 2B and C; LW 3A,B, and C. The leakage appears to be decreasing as the backfill in the borings compacts. The major problem arising from this leakage is in obtaining reliable water quality data.

WATER LEVEL MEASUREMENTS

After each piezometer had been pumped and developed, water level measurements were taken to determine whether it had stabilized and to determine its sensitivity. Measurements for this purpose were carried out at weekly or shorter intervals, depending on rainfall and other factors, until sufficient data had been gathered. In cases where the piezometer response time was very slow, water was added or removed to stabilize the unit. The standpipe diameter of most of the piezometers with slow response time was reduced in the fall of 1967.

After each piezometer had been stabilized, routine measurements were made at monthly intervals to determine seasonal changes in water levels. Additional measurements were made at shorter intervals after rain had fallen or the units had been pumped and sampled. Rainfall at each site was also measured with the piezometers, using a nonrecording gauge.

In the early fall of 1967, a recording rain gauge and a recording barometer were installed at the DuPage County site, in conjunction with three water level recorders equipped with Keck water level sensing devices. The recorders determined the relative effects of precipitation and barometric changes on water levels and aided in evaluating the routine measurements. The water level recorders were usually set in the same nest on holes of different depths, and eight-day charts were generally used.

TABLE 1 - PIEZOMETER AND SAMPLING POINT DATA

MM - Minuteman boring; portable power drill with 3" auger (Mobile Co.)		Screen type	
LW - Contract boring		3	- 3' commercial well point
Yield rating			#10 brass wrap screen (24"
1+ - Pumping rate of more than 5 gpm			screen, 6" each end not
1 - Pumping rate of 1 to 5 gpm		3.5	- 3½' point screen
2 - Makes water at bailing rate (from 1/5 qt/min to 1 gpm)		6	- 6" sump pump screen #10 slot
3 - Will recover in 1 to 2 hours when bailed dry		W	- Wire screen wrapped on drilled
4 - Requires more than 1 day to recover after being bailed dry		TT	- Plastic piezometer tip
			(Terra Test)

Install- tion No.	Length pipe & screen (ft)	Screened interval (ft)	Screen type	Screened in	Yield rating
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DU PAGE COUNTY LANDFILL

MM 1	16		3	Gray silty sand	3
2	10	9 - 9½	W	Gray silty sand	3
3	10		W	Gray silty sand	3
4	10		W	Coarse sand	dry
5	10?		W	Gravelly sand	2
6	10		W	Sand	3
7	20	19½-20	W	Silty clay till	4
8	10	9 - 9½	W	Sand	2
9	20		W	Clay	4
10	10?		W	Clay	4
11	16		W	Sand	3
12	13.04		W	Sand	2
14	13		W	Till	3
15	8		W	Sand	3
16A	10.74		W	Silty sand	3
16B	20		W	Silty clay till	3
17	8.89		W	Silty sand, gravelly	3
18	13		W	Sand	3
19	15?		W	Sand	3
20	18?	14½-15	W	Sand, gravelly	2
21	8.95		W	Sand	3
22	10		W	Sand	2
23	7.74		W	Sand	3
24	7.26		W	Pea gravel	3
25	20		W	Silty clay till	4

TABLE 1 - PIEZOMETER AND SAMPLING POINT DATA - Continued

Installation No.	Length pipe & screen (ft)	Screened interval (ft)	Screen type	Screened in	Yield rating
DU PAGE COUNTY LANDFILL - Continued					
MM 26	20		W	Silty clay till	4
27	20		W	Silty clay till	4
28	10		W	Silty sand	3
29	20	18½-19	W	Sand	2
30	9.68	8½- 9	W	Refuse	dry
31	20		W	Sand	
32	12.58		W	Refuse	3
33	12.10		W	Silty sand	3
34	13.95	11 -11½	W	Gravelly sand	1
35	12.75	10 -10½	W	Gravelly sand	2
36	15.22	12½-13	W	Gravelly sand	3
37	8.8	7 - 7½	W	Gravelly sand	2
38	6.5	5 - 5½	W	Silty sand	2
39	13.2	10½-11	W	Sand	3
40	13.2	11 -11½	W	Sandy silt	3
LW 1A	73	71 -74	3	Dolomite	2
1B	31	29½-31	TT	Till	4
2A	75	72 -75	3	Dolomite	3
2B	41	38 -41	3	Sand and gravel	1
3A	70.5	68½-71½	3	Dolomite	3
3B	20	17½-20	TT	Till	4
3C	42.48	39 -42	3	Sand and gravel	1
3D	48	47½-49	TT	Till	4
4A	93	90 -93	3	Dolomite	2
4B	50	48 -51	3	Till	3
4C	30.5	28½-31½	3	Sand	3
5A	50.12	47 -50	3	Sand and gravel	1
5B	23.46	20 -23	3	Till	2
5C	16.40	13 -13½	6	Silty sand	2
6A	49.00	45½-48½	3.5	Sand and gravel	1
6B	21.00	18 -21	3	Sand	2
6C	8.5	7½- 8	6	Clayey sandy gravel	2

WINNETKA LANDFILL

MM 1	14.7	13½-14	6	Silty clay till	3
2	5.13	4½- 5	6	Silty clay	3

TABLE 1 - PIEZOMETER AND SAMPLING POINT DATA - Continued

Installation No.	Length pipe & screen (ft)	Screened interval (ft)	Screen type	Screened in	Yield rating
WINNETKA LANDFILL - Continued					
MM 3	12.8	10 $\frac{1}{2}$ -11	6	Silty clay till	3
4	20	16 $\frac{1}{2}$ -17	6	Silty clay till	4
5	6.5	4 - 4 $\frac{1}{2}$	6	Silty clay	3
6	7.5	5 $\frac{1}{2}$ - 6	6	Silty sand	2
7	20.5	17 $\frac{1}{2}$ -18	6	Silty clay till	4
8	7.2	5 - 5 $\frac{1}{2}$	6	Silty sand	2
9	7.0	4 $\frac{1}{2}$ - 5	6	Silty sand	3
10	5.5	4 $\frac{1}{2}$ - 5	6	Refuse	2
11	10.5	8 $\frac{1}{2}$ - 9	6	Refuse	3
12	10.5	8 $\frac{1}{2}$ - 9	6	Clay silt	2
13	20.02	17 -17 $\frac{1}{2}$	6	Silty clay till	4
14	9	7 $\frac{1}{2}$ - 8	6	Silty clay till	4
15		10 $\frac{1}{2}$ -12	TT		
23		10 $\frac{1}{2}$ -12	TT	Silty clay till	4
LW 1A	123.48	120 $\frac{1}{2}$ -123 $\frac{1}{2}$	3	Dolomite	2
1B	98.96	95 $\frac{1}{2}$ -98 $\frac{1}{2}$	3	Sand	3
1C	86	83 -86	3	Sand	3
1D	57.65	54 $\frac{1}{2}$ -57 $\frac{1}{2}$	3	Till	3?
1E	15.37	12 -15	3	Refuse	2
2A	124.48	121 $\frac{1}{2}$ -124 $\frac{1}{2}$	3	Dolomite	1
2B	70.45	67 $\frac{1}{2}$ -70 $\frac{1}{2}$	3	Sand	2
2C	37.38	34 -37	3	Sand	2
2D	10.50	7 $\frac{1}{2}$ -10 $\frac{1}{2}$	6	Sandy silt	3
3A	118.70	115 -118	3	Dolomite	1
3B	66.75	63 $\frac{1}{2}$ -66 $\frac{1}{2}$	3	Sand	2
3C	30.85	27 $\frac{1}{2}$ -30 $\frac{1}{2}$	3	Till	3
3D	14.50	11 -13	6	Sand and gravel	2
3E	4.65	4 - 4 $\frac{1}{2}$	6	Sandy silt	dry
4A	126.85	123 $\frac{1}{2}$ -126 $\frac{1}{2}$	3	Dolomite	1
4B	85.02	82 -85	3	Till	3
4C	57.97	55 -58	3	Sand	2
4D	35.16	32 -35	3	Sand	3
4E	16.22	13 -16	6	Sand	2
5A	35.27	32 -35	3	Till	4
5B	12.75	9 $\frac{1}{2}$ -12 $\frac{1}{2}$	3	Refuse	2
6A	58.05	55 $\frac{1}{2}$ -58 $\frac{1}{2}$	3	Sand	2
6B	30.48	27 $\frac{1}{2}$ -30 $\frac{1}{2}$	3	Till	4

TABLE 1 - PIEZOMETER AND SAMPLING POINT DATA - Continued

Installation No.	Length pipe & screen (ft)	Screened interval (ft)	Screen type	Screened in	Yield rating
WINNETKA LANDFILL - Continued					
LW 7A	95.60	92 -95	3	Silty sand	3
7B	44.73	42 -45	3	Sand	3
7C	11.98	9 $\frac{1}{2}$ -12 $\frac{1}{2}$	3	Clay silt	3
8A	64.09	60 -63	3	Sand	2
8B	29.73	26 -29	3	Sand	3
8C	12.18	11 $\frac{1}{2}$ -12	6	Clay silt	3?
9A	66.90	64 -66	3	Sand	2
9B	10.50	10 -10 $\frac{1}{2}$	6	Refuse	3
ELGIN LANDFILL					
MM 1	15?		W	Till	4
LW 1A	43.25	41 -44	3	Dolomite	1
1B	26.4	23 -26	3	Gravel	2
1C	10.55	7 $\frac{1}{2}$ -10 $\frac{1}{2}$	3	Sand and gravel	1
2A	62.23	60 -63	3	Dolomite	1
2B	49.31	46 -49	3	Sand and gravel	1+
2C	11.26	8 -11	3	Sand and gravel	dry
3A	58.41	55 -58	3	Dolomite	2
3B	34.38	31 $\frac{1}{2}$ -34 $\frac{1}{2}$	3	Sand and gravel	1
3C	10.9	8 -11	3	Sand and gravel	3?
4A	49.72	46 $\frac{1}{2}$ -49 $\frac{1}{2}$	3	Dolomite	1
4B	37.50	34 $\frac{1}{2}$ -37 $\frac{1}{2}$	3	Sand and pea gravel	1
4C	23.90	20 $\frac{1}{2}$ -23 $\frac{1}{2}$	3	Sand and pea gravel	1
4D	11.67	8 $\frac{1}{2}$ -11 $\frac{1}{2}$	3	Sand and pea gravel	dry
5A	21.61	18 $\frac{1}{2}$ -21 $\frac{1}{2}$	3	Silty sand	2
5B	16.05	10 $\frac{1}{2}$ -13 $\frac{1}{2}$	3	Sand and gravel	1
6A	41.35	38 -41	3	Silty sand	1
6B	21.83	18 $\frac{1}{2}$ -21 $\frac{1}{2}$	3	Gravel and sand	2
7A	33.79	30 -33	3	Silty sand	2
7B	25.16	22 -25	3	Sand and gravel	3
8A	36.69	33 $\frac{1}{2}$ -36 $\frac{1}{2}$	3	Sand	1
8B	18.04	15 -18	3	Sand and gravel	1
9A	31.83	28 -31	3	Sand and gravel	1
9B	15.83	12 -15	3	Sand and gravel	1
Well 1	7.9	?		Sand and gravel	2
Well 2	19.8	?		Sand and gravel	1

TABLE 1 - PIEZOMETER AND SAMPLING POINT DATA - Continued

Installation No.	Length pipe & screen (ft)	Screened interval (ft)	Screen type	Screened in	Yield rating
WOODSTOCK LANDFILL					
MM 1	9.2	7½- 8	W	Sand	1
2	18.4	17 -17½	6	Gravelly sand	3
3	8.0	6½- 7	W	Silt	3
4	20.5	18½-19	W	Gravel	1
5	12.5	10½-11	6	Silty sand	3
6	8.6	6 - 6½	6	Sand and gravel	1
7	10.5	8½- 9	6	Organic silt	2
8	17.5	15 -15½	6	Organic silt	3
9	10.5	8½- 9	6	Organic silt	2
10	10.5	8 - 8½	6	Organic silt	3
LW 1A	223.68	220½-223½	3	Sand and gravel	4
1B	34.21	31 -34	3	Sand and gravel	2
1C	25.25	22 -25	3	Silt	2
1D	14.45	11½-14½	3	Refuse	3
2A	148.45	145 -148	3	Sand and gravel	2
2B	79.18	76 -79	3	Sand and gravel	2
2C	57.00	53½-56½	3	Sand and gravel	2
2D	8.95	8½- 9	6	Till	2
2E	5.14	4½- 5	6	Sand and gravel	1+
3A	195.04	192 -195	3	Sand and gravel	2
3B	165.20	162 -165	3	Clay over sand and gravel	3
3C	104.96	101½-104½	3	Sandy till	3
3D	65.04	62 -65	3	Sand and gravel	1+
3E	23.37	19 -22	3	Sand and gravel	1
3F	7.94	7 - 7½	6	Sand and gravel	2
4A	121.14	118 -121	3	Sand	2
4B	105.56	102 -105	3	Silty sand	1+
4C	73.23	70 -73	3	Sand	1
4D	29.47	26½-29½	3	Sand and gravel	1
4E	13.87	13 -13½	6	Sandy silty till	dry
5A	46.85	44 -47	3	Sand	1
5B	23.00	18½-21½	3	Sandy silt	1
5C	10.50	9½-10	6	Sandy silt	2
6A	39.88	31 -34	3	Sand and gravel	1+
6B	10.99	8 -11	3	Refuse	3

SAMPLE DESCRIPTIONS

Following are sample logs from each of the contracted borings made in this investigation. In nests where separate borings were used for each piezometer, a composite log is given.

TABLE 2 - SAMPLE DESCRIPTIONS

DU PAGE COUNTY LANDFILL		DU PAGE COUNTY LANDFILL - Continued	
Boring LW 1		Boring LW 4	
	<u>Depth (ft)</u>		<u>Depth (ft)</u>
Black, clayey silt topsoil	0 - 3	Clayey silt cover material	0 - 1½
Yellow-brown to black silty sand, coarse grained grading to fine grained; black oily staining and odor	3 -14	Refuse—some garbage, glass, 1958 and 1964 newspapers	1½-15
Gray, silty clay till	14 -24	Gravelly sand, silty	15 -19
Gray, sandy silt till	24 -46	Silty sand, very fine grained; black staining and odor; bedded at 28-29'; medium to very coarse grained at 30-36'	19 -36
Gray, silt till	46 -64½	Gray, silty clay till	36 -41
Yellow-brown to light gray pebbly dolomite	64½-76	Sandy silt till	41 -50
		Gray silt till, pebbly (poor samples at 50-80')	50 -88
Boring LW 2		Light gray dolomite	88 -93
Sand and gravel grading to silty sand at base	0 -15½		
Gray, silty clay till	15½-40	Boring LW 5	
Brown to black fine-grained sand	40 -41½	Clayey silt cover material	0 - 3
Gray, silty clay till	41½-45	Refuse—legible papers, wood, cans	3 -15½
Gray silt till	45 -70	Silty sand to sand, fine grained; bedded at 17½-19'	15½-24½
Light gray and pinkish gray dolomite	70 -77	Brown to gray silty clay till	24½-33½
		Arbitrary pick for base	
Boring LW 3		Gray, sandy silt till, pebbly	33½-45
Brown to black clayey silt topsoil, sandy at base	0 - 3½	Gray, sandy silt	45 -46½
Silty sand, fine grained, dirty at top and base	3½-14	Sand and gravel, medium to coarse grained	46½-50½
Gray, silty clay till	14 -21	Gray silt till (poor samples)	50½-51½
Gray silt till, pebbly	21 -40½		
Gray, silty clay till	40½-41½	Boring LW 6	
Sandy gravel	41½-46½	Clayey silt cover material	0 - 3
Gray silt till, pebbly at 60-65'	46½-65	Refuse	3 - 4½
Yellow-brown to light gray dolomite	65 -73	Sandy silt, roots; probably old soil	4½- 6
		Sand and gravel, silty	6 -11

TABLE 2 - SAMPLE DESCRIPTIONS - Continued

DU PAGE COUNTY LANDFILL - Continued

Boring LW 6 (Continued)

	<u>Depth (ft)</u>
Silty sand, fine grained grading to medium grained	11 - 16
Black sandy silt	16 - 25½
Gray, silty clay till	25½- 43
Silty sand, medium grained grading to very fine grained	43 - 48½
Gray, silty clay till (no sample)	48½- 49½

WINNETKA LANDFILL

Boring LW 1

Black, sandy, clayey silt cover material	0 - 1
Cinders	1 - 2
Refuse—paper, plastic, wood	2 - 14
Probably silt (poor samples)	14 - 20
Gray, clayey silt till	20 - 38
Silty sand (no samples)	38 - 40
Gray, sandy, clayey silt till; thin sand, some gravel at 48-48½', 58-64½', 83½-88', 94-96', 101-103'	40 -118
White to light gray dolo- mite bedrock; creviced (lost circulation)	118 -124

Boring LW 2

Cinder fill	0 - 2
Black organic clay, soil	2 - 3
Brown sandy silt	3 - 8½
Gray, clayey silt till	8½- 31
Black shale, pebble gravel	31 - 32
Gray, sandy, clayey silt till, pebbly; thin sand stringers at 66½-68½' and 85½-86'	32 -108
White to light gray dolomite bedrock; some till fragments	108 -125

WINNETKA LANDFILL - Continued

Boring LW 3

	<u>Depth (ft)</u>
Fill material (not refuse)	0 - 4½
Brown, clayey, sandy silt	4½- 8½
Gray clay	8½- 11
Shale sand and gravel	11 - 13
Gray, clayey silt till	13 - 28
Gray, sandy, clayey silt till, often gravelly; sand stringers at 62-62½', 78', 82', 92½-93'	28 -112½
White to light gray dolo- mite bedrock	112½-118

Boring LW 4

Fill (not refuse)	0 - 3
Black sandy silt	3 - 4
Brown to gray silty clay	4 - 13½
Black shale sand	13½- 14
Gray, clayey silt till	14 - 32
Shale sand, medium grained	32 - 33
Gray, sandy, clayey silt till; gravelly till at 35½-36'; shale sand at 51-52'; sand at 64-65'; very gravelly till at 95-110'	33 -110
White to light gray dolo- mite bedrock; some till fragments (probably cave)	110 -121

Boring LW 5

Gray to black silty sandy clay cover	0 - 3
Refuse—glass, fiber, mostly unrecognizable black material	3 - 11½
Probably silty alluvium (poor samples)	11½- 13½
Gray, clayey silt till; more stones near base; 1" sand at 33', 33½'	13½- 36

TABLE 2 - SAMPLE DESCRIPTIONS -- Continued

WINNETKA LANDFILL - Continued

Boring LW 6

	Depth (ft)
Black, clayey silt soil	0 - 1½
Gray, sandy silt	1½ - 5½
Gray, clayey silt till; brown to brown-gray at 5½-8½'; sandy till at 14½-16'	5½-52½
Gray, sandy, clayey silt till; very sandy at 52½-54'	52½-57
Gray, fine- to medium-grained sand	57 - 58½

Boring LW 7

Black, sandy silt soil	0 - 3½
Brown silt with sand stringers	3½ - 5
Gray, clayey silt	5 - 11
Gray, clayey silt till	11 - 33
Gray, sandy, clayey silt till	33 - 41½
Black shale sand	41½ - 43½
Gray, sandy, clayey silt till; silty sand at 91½-94'	43½-95

Boring LW 8

Black, sandy silt soil	0 - 2½
Yellow-brown clayey silt, sandy at 5½-6½'; possible sand at 12-13'	2½-13
Gray, clayey silt till	13 - 26
Black shale sand	26 - 27
Gray, sandy, clayey silt till; black shale sand at 42½- 43', 60½-63'	27 - 70

Boring LW 9 (no samples)

Soil and clay cover	0 - 1½
Refuse--only a few cans were distinguishable	1½-12½
Gray, clayey, silt till (?); possible fine sand at 22'	12½-42½
Drilling break, possible silt	42½-43½
Gray, clayey till, softer	43½-47

WINNETKA LANDFILL - Continued

Boring LW 9 (Continued)

	Depth (ft)
Possible shale sand	47 - 48
Harder till	48 - 63½
Gray silt to fine sand	63½-69
Gray fine sand	69 - 73

ELGIN LANDFILL

Boring LW 1

Black, sandy silt soil; sand and gravel fill	0 - 7½
Sand and gravel	7½-11
Light pink, sandy silt till	11 - 16
Peat or soil horizon	16 - 16½
Brown-gray, sandy silt till	16½-24½
Sand and gravel	24½-26½
Gray, sandy, silty till	26½-30
Silty sand; white clay	30 - 32
Light gray dolomite bedrock	32 - 46

Boring LW 2

Clayey, silty sand cover material	0 - 2
Refuse--glass, cinders	2 - 7
Sand and gravel	7 - 10
Pink, sandy silt till	10 - 20
Yellow, light pink, sandy silt till	20 - 27
Brown-gray, sandy silt till	27 - 44½
Gravel	44½-48
Yellow-brown, sandy silt till	48 - 53½
Yellow-brown to light gray dolomite bedrock	53½-63

Boring LW 3

Brown, silty clay topsoil	0 - 3
Sand and gravel	3 - 11
Pink, sandy, silty till	11 - 13
Brown-gray, sandy, silty till; some yellow-pink thin gravel seams at 16-18'; wood at 28½'	13 - 32½

TABLE 2 - SAMPLE DESCRIPTIONS - Continued

ELGIN LANDFILL - Continued

Boring LW 3 (Continued)

	<u>Depth (ft)</u>
Sand and pea gravel, very coarse grained	32½-49
Yellow-brown to light gray dolomite bedrock	49 -58

Boring LW 4

Brown to black, sandy silt cover material	0 - 2
Refuse—wood, glass, metal	2 -14
Sand and pea gravel	14 -23
Light pink, sandy silt till	23 -30
Brown-gray, sandy silt till	30 -34½
Sand and pea gravel	34½-37½
White clay and weathered dolomite	37½-39
Yellow-brown to light gray dolomite bedrock	39 -52

Boring LW 5

Brown to black sandy silt cover intermixed with refuse—cinders, ash, paper board	0 -11½
Sand and gravel (no sample)	11½-16½
Pink, sandy silt till	16½-18
Brown-gray, sandy silt till	18 -21
Silty sand, fine grained	21 -21½
Brown-gray, sandy silt till	21½-28½

Boring LW 6

Logged cover, refuse—paper, wood, glass, ashes (no samples or poor recovery)	0 -14
Sand and gravel becoming silty with depth	14 -22
Light pink, sandy silt till	22 -27
Brown-gray, sandy silt till	27 -34½
Sand and pea gravel	34½-35
Brown-gray, sandy silt till; wood fragments	35 -36½
Sandy silt, silty sand and gravel	36½-39½

ELGIN LANDFILL - Continued

Boring LW 6 (Continued)

	<u>Depth (ft)</u>
White clay, weathered dolomite fragments	39½-41
Refusal; probably bedrock	41

Boring LW 7

Cover, refuse—cinders, ash, glass	0 -15
Silty sand, minor gravel	15 -25½
Light pink, sandy silt till	25½-28
Gray to black silty sand	28 -29
Brown-gray, sandy, silty till	29 -32
Silty sand, very fine to fine grained	32 -32½
Brown-gray, sandy silt till	32½-33

Boring LW 8

Gravel and sand, fine grained; very coarse sand at base	0 -19½
Pink, sandy silt till	19½-20
Light gray, sandy silt	20 -21
Brown-gray, sandy silt till	21 -31
Sand, coarse to very coarse grained	31 -35½
Brown-gray, sandy silt till; white silty clay and dolomite fragments	35½-36½

Boring LW 9

Black, sandy topsoil	0 - 2
Sand and gravel, poorly sorted	2 -20
Brown-gray, sandy silt till	20 -25
Gravel and sand, fine grained	25 -30½
Dolomite bedrock	30½-31½

WOODSTOCK LANDFILL

Boring LW 1

Refuse—cinders, glass, metal (poor samples)	0 -19½
Gray silt (poor samples)	19½-24½

TABLE 2 - SAMPLE DESCRIPTIONS - Continued

WOODSTOCK LANDFILL - Continued

Boring LW 1 (Continued)

	<u>Depth (ft)</u>
Sand and gravel, very coarse grained	24½- 42½
Brown-gray, silty clay till	42½- 50
Pink, sandy silt till; pebbly at 67-71'; wood fragments at 105-110'—possibly cave; silty sand, possible stringers at 110-115'	50 -123
Gravel; some very coarse-grained sand	123 -132
Pink, sandy silt till; pebbly at 145-150', 155-160'	132 -160
Brown, pebbly, sandy silt, probably till; wood fragments	160 -167
Black, silty clay, probably soil	167 -170
Brown-gray, sandy silt till	170 -180½
Fine sand (no samples)	180½-187½
Brown-gray, sandy silt till	187½-203
Sand, medium to coarse grained	203 -207
Brown-gray, sandy silt till	207 -213
Sand and gravel; some till—probably cave	213 -225
Boring LW 2	
Black, silty clay soil	0 - 1½
Gravel, sandy	1½- 7
Gray, silty clay till	7 - 32
Pink, sandy silt till; stringer of sand and gravel at 50-52', 55-57', 66-69', 76-78'	32 -138
Sand and gravel	138 -155
Boring LW 3	
Black, silty clay soil	0 - 2
Brown, sandy clay	2 - 3
Sand and gravel, sandier at base	3 - 22

WOODSTOCK LANDFILL - Continued

Boring LW 3 (Continued)

	<u>Depth (ft)</u>
Gray, silty clay till	22 - 42½
Pink, sandy silt till; medium-grained sand at 53½-54'; sand and gravel at 57-64'; brown clay (not till) at 64-67'; sand and gravel at 67-70'; very little sand in till at 70-80'	42½-122
Gray, sandy silt till; some pink	122 -130
Pink, sandy silt till	130 -149
Brown-gray, sandy silt till	149 -161
Brown-gray, sandy silt till, pebbly; possibly a very silty sand and gravel (E-log would indicate former)	161 -165
Black, silty clay soil	165 -172
Brown-gray, sandy silt till	172 -180
Sand and gravel	180 -185
Brown-gray, sandy silt till	185 -187½
Sand and gravel	187½-195
Boring LW 4	
Black, silty clay soil	0 - 1
Brown, sandy clay, gravelly	1 - 4
Sand and gravel	4 - 7
Pink-brown, sandy silt till, gravelly; mostly gravel at 10-20'—probably ice-contact	7 - 25½
Gray sand and gravel, very coarse grained	25½- 29
Brown-gray, sandy silt till, gravelly	29 - 44
Gray, silty clay till	44 - 68
Gravel	68 - 72½
Pink-gray, sandy silt till, gravelly; till in chunks	72½- 92½
Sand and gravel	92½- 95½
Pink, sandy, silty till	95½-100
Silty sand, medium grained; some gravel	100 -106
Pink, sandy, silty till; sand at 116½-118'	106 -121

TABLE 2 - SAMPLE DESCRIPTIONS - Continued

WOODSTOCK LANDFILL - Continued		WOODSTOCK LANDFILL - Continued	
Boring LW 5		Boring LW 6	
	Depth (ft)		Depth (ft)
Black silt soil	0 - 4	Cover, refuse--ashes, wood,	
Brown to gray sandy silt,		and indistinguishable fill	0 -15
very fine grained	4 -23	Peat and clayey silt, spongy	15 -23
Gray, silty clay till	23 -44	Sand and gravel, coarse	
Sand, fine to coarse grained	44 -45½	grained grading to fine	
Pinkish gray, sandy silt till	45½-51	grained	23 -34½
		Gray, silty clay till	34½-37½
		Pinkish gray, sandy silt	
		till; pink at 36½-37½'	37½-58

TABLE 3 - SIEVE ANALYSES

Boring	Depth (ft)	Material	Total sample	Sample <2 mm diameter		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)
DU PAGE COUNTY LANDFILL						
	surface	cover on fill	3	14	60	26
	surface	cover on fill	8	12	53	35
	surface	cover on fill	3	13	55	32
	surface	cover on fill	8	11	51	38
	surface	topsoil	9	20	43	37
	surface	topsoil	15	36	36	28
LW 1B	3-4.5	surficial sand	38	45	37	18
1B	10.5-12	surficial sand	0	25	64	11
2B	12-13.5	surficial sand	14	20	61	19
4B	18-19.5	surficial sand	1	46	41	13
		(below fill)				
4B	27.5-29	surficial sand	1	16		84
		(below fill)				(mostly silt)
1B	17-18.5	upper till	5	11	55	34
2B	17-18.5	upper till	6	10	53	37
3B	17-18.5	upper till	10	7	71	22
4B	48-49.5	middle till	23	35	44	21
5	42-43.5	middle till	21	35	45	20
2B	40-41.5	interbedded sand	29	76	16	8
2B	41.5-43	interbedded sand	30	86		14
3C	42-43.5	interbedded sand	36	86		14
5	50-51.5	interbedded sand	14	87		13
6	44.5-46	interbedded sand	3	95		5

TABLE 3 - SIEVE ANALYSES - Continued

Boring	Depth (ft)	Material	Total sample	Sample <2 mm diameter		
			Gravel (%)	Sand (%)	Silt (%)	Clay (%)
WINNETKA LANDFILL						
LW 6	9.5-11	upper till	9	19	53	28
6	24.5-26	upper till	3	17	49	34
6	34.5-36	upper till	5	10	41	49
6	47-48.5	lower till	1	42	45	13
	surface	cover on fill	1	32	40	28
	surface	topsoil	5	11	66	23
	surface	topsoil	0	8	64	28
	surface	topsoil	0	26	46	28
LW 6	4.5-6	surficial silt	1	21	51	22
5	13.5-15	upper till			bad reading	
5	26-27.5	upper till	3	13	48	39
5	31.5-33	upper till	4	10	46	44
WOODSTOCK LANDFILL						
	surface	cover on fill	33	53	31	16
	surface	cover on fill	16	26	61	13
	surface	cover on fill	9	15	49	36
	surface	topsoil	1	50	34	16
	surface	topsoil	0	94		6
LW 5	24.5-26	upper till	8	14	44	42
5	42-43.5	upper till	3	11	51	38
6	35-36.5	upper till	4	10	48	42
5	49.5-51	lower till	11	39	36	25
6	39.5-41	lower till	12	44	38	18
6	54.5-56	lower till	22	41	36	23
ELGIN LANDFILL						
	surface	cover on fill	40	40	27	33
LW 8	15-16.5	surficial sand	3	10	84	6
8	17.5-19	surficial sand	14	96		4
6	19.5-21	surficial sand	55	79		21
6	24.5-26	upper till	13	27	41	32
6	32-33.5	upper till	7	33	42	25
6	38-39.5	basal sand	55	76		24

TABLE 4 - CLAY MINERAL ANALYSES

Landfill	Boring	Depth (ft)	Percent <2 μ fraction		
			Mont- morillonite	Illite	Chlorite & kaolinite
DuPage County	LW 6	26-27.5	2	79	19
	LW 6	39.5-41	2.5	71.5	26
Elgin	LW 5	16.5-17	15	67.5	17.5
	LW 5	21-22.5	11	65	24
Winnetka	LW 5	12-13.5	3	80	17
	LW 5	17-18.5	2.5	81	16.5

PUMPING AND SAMPLING PROCEDURES AND QUALITY ANALYSES

General Procedure

After each piezometer or sampling point was installed, it was developed and pumped with a windmill pump jack, a contractor's pump, or an air compressor. For those wells pumped with the pump jack, a plastic seat had been installed with the well screen, into which a ball bearing was dropped to serve as a foot valve. The pipe was used as the cylinder. The ball bearing was removed by a magnet after pumping had been completed. This initial pumping was continued until the water was clear or the chloride content became constant, and measurement was made in the field with a Hatch kit.

Samples were taken after the fluid had been exchanged at least twice in the screen and standpipe. This was done with the pump jack, contractor's pump, air compressor, or a bailer, depending on the depth, water level, and capacity of the particular point. The samples were usually collected with a rinsed bailer, put in mason jars, and sent immediately to the laboratory for analysis. No special precautions were taken to avoid loss of gases or to impede biologic activity during transportation to the laboratory.

Comments on the Results of Analyses

Considerable variation appeared in the results of the quality analyses that seemed to be unrelated to the distance of the leachate from the landfill or the age of the landfill. Three types of variations were noted.

- 1) Samples taken from adjacent borings, with depth variations as little as 4 feet and not separated by any apparent permeability barrier, were consistently different. The shallower boring had as much as 50 percent fewer total dissolved solids than the deeper boring.

- 2) Samples taken on successive weeks from the same boring differed.
- 3) Samples taken before and after exchanging the water in the sampling point differed in constituents such as chlorides.

This variability, combined with the errors inherent in the sampling and analytical procedures made it impossible to calculate the amount of dissolved solids adsorbed during travel through specific types of materials. The data were, however, adequate for definition of the envelope of dissolved solids around each fill.

Biologic contaminants were not investigated as this would have involved chlorinating the sampling points and a more refined sample collection procedure.

Quality Analysis by the Illinois State
Department of Public Health

Table 5, prepared by the Illinois State Department of Public Health, lists the procedure used for the various analyses and the precision of these methods. The table appears on the next page.

TABLE 5 - METHODS OF ANALYSIS USED BY THE ILLINOIS
STATE DEPARTMENT OF PUBLIC HEALTH

Determination	Procedure	Precision
Specific conductance	Standard Methods* - 12th ed., page 283	$\pm 5\%$
pH	Standard Methods - 12th ed., page 226	± 0.1 pH unit
Chemical oxygen demand	Standard Methods - 12th ed., page 510	Standard deviation with glucose is $\pm 8.2\%$ of mean
Organic acids	Colorimetric method	$\pm 2\%$
Hardness	EDTA titrimetric method; Standard Methods - 12th ed., page 147	$\pm 3\%$
Sulfate	Turbidimetric method	$\pm 5\%$
Sodium	Estimation	
Chloride	Mercuric nitrate method	$\pm 1.4\%$
Iron	Phenanthroline method; Standard Methods - 12th ed., page 156	$\pm 3\%$
Manganese	Persulfate method; Standard Methods - 12th ed., page 173	$\pm 3\%$
Nitrate	Phenoldisulfonic acid method; Standard Methods - 12th ed., page 195	$\pm 2\%$

* "Standard Methods for the Examination of Water and Waste Water," American Public Health Association et al., New York, 1965.

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation No.		Sam- pling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
DU PAGE COUNTY								
LW	1A	b*	71 -74	10- 3-67	9673	382	7.5	32
	1A	b	71 -74	11-29-67	13445	314	8.0	24
	2B	b	38 -41	10- 3-67	9670	426	7.7	44
	3C	b	39 -42	10- 3-67	9671	376	7.6	20
	3C	b	39 -42	11-29-67	13450	388	8.0	22
	4A	b	90 -93	10- 3-67	9675	382	7.5	91
	4C	b	28½-31½	11-13-67	12697	374	8.4	4
	5A	PJ*	47 -50	8- 8-67	4596	348	7.7	36
	5B	CP*	20 -23	8- 8-67	4597	6712	6.7	1813
	5B	CP	20 -23	8-31-67	6999	11254	6.4	35700
	5B	CP	20 -23	9- 6-67	7500	11875	6.4	51400
	5B	CP	20 -23	9-21-67	8751	12589	6.5	44600
	5B	CP	20 -23	10- 3-67	9672	13409	6.2	45646
	5B	CP	20 -23	10-24-67	11283	11465	7.6	20700
	5B	CP	20 -23	11- 7-67	12157	8047	6.5	17088
	5C	CP	13 -13½	8- 8-67	4598	6712	6.7	1863
	6A	PJ	45½-48½	8- 9-67	4599	353	7.9	8
	6A	b	45½-48½	11-28-67	13456	381	7.9	22
	6B	CP	18 -21	8- 9-67	4600	1703	7.3	167
	6B	CP	18 -21	9- 6-67	7493	1715	7.1	180
MM	6B	b	18 -21	11-28-67	13449	2075	7.5	238
	6C	CP	7½- 8	8- 9-67	4601	1372	7.3	143
	2	b	9 - 9½	9-21-67	8752	1976	7.0	202
	2	b	9 - 9½	10- 3-67	9666	1988	7.2	206
	3	b		9- 6-67	7496	4980	7.4	873
	5	b		8- 9-67	4605	1084	7.4	68
	5	b		11-28-67	13444	1012	7.3	103
	12	b		10- 3-67	9669	9004	6.7	19068?
	15	b		10-25-67	11284	908	7.4	40
	17	b		10-25-67	11278	1488	6.9	58
	18	b		8- 9-67	4603	3250	7.5	480
	18	b		11-28-67	13453	3091	7.5	260
	19	b		10- 3-67	9668	2865	7.2	210
	20	b	14½-15	10- 3-67	9674	2334	7.2	249
	20	b	14½-15	11-29-67	13448	2842	7.5	290

* b - bailed; CP - contractor's pump; PJ - pump jack

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL							
40	290	8	42	18	126	0	
neg.	265	4	23	6	55	0	
20	320	29	49	25	139	0	
55	340	23	17	15	97	0	
neg.	330	21	27	9	18	0	
neg.	340	17	19	23	70	0.1	
neg.	336	68	17	11	27	0.4	
70	310	18.0	18	8	2.3	0	
1840	4620	295.0	962		38.0	0	
7650	8700	940	1200	1100	206		Detergents, 2.0
4500	9000	1600	1323	2250	409.6	0	
3950	9000	820	1651	1900	400.0		
9200	10600	1200	1292	2000	774	0	
6850	8900	451	1180	1750	762	0	
9150	5200	190	1310	1075	461	0	
6700	4960	380.0	806		40.0	0	
0	350	16.8	2	10	6.8	0	
neg.	320	30	28	10	38	0	
60	590	7.6	512		6.0	0	
neg.	590	6.4	518	185	25.6	0	
neg.	500	24	725	220	110	0	
80	590	8.4	360		15.2	0.2	
neg.	840		523	240	49.6	neg.	
neg.	740	15	914	400	416	0	
20	840	26	1904	800	192.0	0	
100	720	146.0	167		4.2	Tr 0.1	
neg.	470	66	249	120	400	0.2	
5900	6100	58	1336	1500	454	0	
neg.	520	34	178	250	288	0.2	
neg.	1040	27	206	300	400	0.7	
40	1450	92	828	2	27.7	0	
neg.	780	31	1063	450	440	0	
neg.	1600	4	582	925	142	0	
50	780	9	715	325	67	0	
neg.	740	25	967	380	300	0	

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.	Sam- pling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
DU PAGE COUNTY							
MM 21	b		10- 3-67	9667	788	7.4	91
22	b		10-25-67	11280	618	6.3	20
23	b		9- 6-67	7502	802	7.1	51
24	b		9- 6-67	7497	494	7.3	63
34	b	11 -11½	9- 2-67	7501	1506	7.3	71
34	b	11 -11½	11-29-67	13447	1291	7.8	68
39	b	10½-11	10-25-67	11277	599	7.3	18
40	b	11 -11½	10-25-67	11281	636	7.2	20
41	b	11 -11½	10-24-67	11286	594	7.4	246
DuKane Asphalt Plant			9- 6-67	7498	317	7.7	14
			11- 1-67	11572	319	7.5	6
Farm Well			8- 9-67	4604	321	7.9	0
Amax Alum.			8- 9-67	4602	392	7.7	4
Amax Alum.			11- 1-67	11568	407	7.3	6
Recora Plant			9- 6-67	7499	358	7.8	16
Kress Creek 200'N MM 9			1-24-68	17509	551	7.8	2
S. side of rd. near MM 3			1-24-68	17510	2695	7.0	230
Kress Creek near MM 12			1-24-68	17511	554	7.9	4
Kress Creek near LW 2			1-24-68	17512	559	7.3	3
Kress Creek at bend, middle of field			1-24-68	17513	563	7.3	8
WINNETKA							
LW 1A	PJ	120½-123½	10-18-67	10684	332	7.7	24
1A	b	120½-123½	12- 5-67	13961	439	7.5	43
1E	CP	12 - 15	8-17-67	6275	5146	7.4	737
1E	b	12 - 15	11-15-67	12698	4750	7.6	668
2A	PJ	121½-124½	8-16-67	6273	247	8.0	18
2B	PJ	67½- 70½	8-18-67	6271	1060	7.3	57
2B	b	67½- 70½	10-28-67	10682	548	7.5	36
2B	b	67½- 70½	12- 4-67	13955	463	7.5	28
2C	b	34 - 37	9-20-67	8755	2548	6.9	169
2C	CP	34 - 37	10-18-67	10680	2471	7.1	113

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL - Continued							
neg.	520	22	120	157	403	0.1	
neg.	460	18	73	48	333	0	
neg.	570	9	107	175	24.0	0.3	
neg.	400	76	43	58	22.8	0.3	
neg.	820	10	316	248	144	0	
neg.	460	43	382	220	440	0	
neg.	480	339	55	63	22	0	
55	570	230	30	18	70	0.5	
neg.	460	646	62	23	30	0.2	
neg.	240	10	35	5	1.0	0	
neg.	250	11	32	5	1.0	0	
40	270	20.0	23	8	0.55	0	
40	320	68.0	33	5	0.2	0	
neg.	310	88	44	8	0.2	0	
20	330	54	13	6	0.6	0	
neg.	330	162	102	48	0.4	0	
50	500	150	1010	290	78	0	
35	330	160	103	51	0.4	0	
neg.	350	164	96	37	0.6	0	
50	370	195	89	38	0.7	0	
LANDFILL							
neg.	140	6	88	60	128	0	
20	180	20	119	65	8	0.2	
20	990	0	1912	115	27.0	0	
110	1080	48	1688	1040	68	0	
0	98	24	69	46	30.0	0.2	
0	590	114	216	249	34.0	0.2	
neg.	290	36	119	113	304	0.3	
neg.	230	26	107	88	160	0.2	
neg.	1480	227	491	770	170	0.1	
neg.	1340	210	520	695	83	0.3	

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.		Sam- pling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
WINNETKA								
LW	3A	PJ	115 -118	8-21-67	6277	223	7.5	18
	3A	PJ	115 -118	8-23-67	6279	442	7.3	22
	3A	b	115 -118	10-18-67	10679	365	7.5	20
	3A	AC*	115 -118	12- 5-67	13958	389	7.9	18
	3B	b	63½- 66½	8-30-67	7495	1286	7.0	129
	3B	b	63½- 66½	10-18-67	10685	1827	7.0	190
	3C	PJ	27½- 30½	8-30-67	7494	1715	7.1	186
	3C	b	27½- 30½	10-18-67	10687	1882	6.8	145
	3D	CP	11 - 13	8-21-67	6276	1501	7.0	119
	3D	b	11 - 13	10-17-67	10688	1939	6.9	157
	4A	CP	123½-126½	9-10-67	8144	224	8.0	121
	4C	PJ	55 - 58	9-18-67	8756	631	7.7	20
	4C	b	55 - 58	10-16-67	10678	450	7.4	28
	4E	CP	13 - 16	9-19-67	8757	1330	7.4	52
	4E	b	13 - 16	10-17-67	10686	1341	7.1	48
	5B	b	9½- 12½	8-17-67	6278	2918	7.0	299
	5B	b	9½- 12½	11-15-67	12695	2941	8.0	280
	6A	PJ	55½- 58½	9-20-67	8758	218	8.1	8
	6A	b	55½- 58½	9-28-67	10155	261	7.5	6
	7A	b	92 - 95	12- 5-67	13957	593	7.3	18
	7B	b	42 - 45	11- 6-67	12159	376	7.5	23
	7B	b	42 - 45	12- 5-67	13954	436	7.5	39
	7C	b	9½- 12½	12- 5-67	13956	1022	7.1	22
	8A	b	60 - 63	11-10-67	12692	268	7.8	0
	8A	AC	60 - 63	11-14-67	12693	238	8.3	4
MM	8B	b	26 - 29	11-15-67	12696	435	8.2	31
	9A		64 - 66	11-10-67	12694	301	7.6	19
	5	b	4 - 4½	12- 5-67	13953	2524	7.0	581
	6	CP	5½- 6	8-16-67	6272	1236	7.5	31
	6	b	5½- 6	10-16-67	10681	1466	7.3	20
	8	b	5 - 5½	12- 5-67	13962	1625	7.3	102
	8	b	5 - 5½	1-25-68	17514	1421	7.1	50
	9	b	4½- 5	12- 5-67	13959	4235	7.2	102
	9	b	4½- 5	1-25-68	17515	4060	7.3	35
	10	CP	4½- 5	8-15-67	6274	3379	7.1	517

* AC - Air compressor

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL - Continued							
0	190	8	15	51	30	0.2	
20	260	18	84	61	27.0	0.2	
neg.	170	4	90	90	50	0.2	
15	172	7	99	62	3	0.1	
neg.	810	38	219	200	150.4	0.2	
neg.	1110	14	330	475	342	0.1	
neg.	1200	6.8	237	360	45.2	0	
neg.	1270	14	282	440	80	0	
0	800	32	322	275	36.0	0	
neg.	1170	15	354	440	362	0	
40	80	6	66	31	9.6	0.7	
neg.	370	66	120	118	20.4	0.5	
neg.	240	26	97	110	262	0.4	
neg.	890	157	202	323	14.8	0.2	
neg.	1020	274	148	295	108	1.2	
0	760	18	993	590	22.0	0	
40	720	11	1012	610	269	0	
neg.	92	16	58	34	4.8	neg.	
neg.	108	0	670	40	28	0	
neg.	370	116	103	39	15	0.2	
neg.	90	67	132	33	29	0	
20	230	66	95	31	5	0.2	
neg.	880	340	65	80	30	0.2	
neg.	172	28	44	39	339	0	
neg.	100	20	63	37	25	0	
30	152	130	130	33	26	0	
30	124	22	81	45	78	0	
40	1320	140	554	360	150	0	
0	920	500	145	190	7.0	0.1	
neg.	1390	730	35	208	110	0.8	
30	840	38	361	390	300	0.5	
neg.	710	103	327	355	162	0.2	
neg.	1500	215	1258	1950	140	0	
35	1480	208	1187	2000	68	0	
0	890	0	1145	650	23.0	0	

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.	Sam- pling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
WINNETKA							
MM 10	b	4½- 5	11-15-67	12699	3250	7.7	384
11	b	8½- 9	9-20-67	8759	5560	6.7	5826
11	b	8½- 9	11-15-67	12700	5938	7.3	10800
12	b	8½- 9	11-15-67	12701	1328	7.8	0
12	b	8½- 9	12- 5-67	13960	1119	7.2	32
ELGIN							
LW 1A	CP	41 -44	7-27-67	3125	498	7.2	50
1A	N*	41 -44	8- 2-67	3805	412	7.0	20
1A	CP	41 -44	9-27-67	9260	401	7.3	16
1B	CP	23 -26	7-27-67	3124	415	7.1	30
1B	CP	23 -26	8-30-67	7004	428	7.1	28
1C	CP	7½-10½	7-27-67	3123	523	7.2	70
1C	CP	7½-10½	8-30-67	7003	1946	7.0	44
2A	N	60 -63	7-27-67	3128	412	7.5	23
2A	N	60 -63	8- 2-67	3808	393	7.4	12
2A	CP	60 -63	9-26-67	9264	376	7.6	4
2B	CP	46 -49	7-27-67	3129	391	7.7	20
2B	CP	46 -49	9-26-67	9261	383	7.6	8
3A	CP	55 -58	7-27-67	3132	349	8.0	110
3A	N	55 -58	8- 2-67	3799	371	7.3	22
3A	CP	55 -58	9-26-67	9263	376	7.6	8
3B	CP	31½-34½	7-27-67	3133	374	7.7	235
3B	AC	31½-34½	9-26-67	9262	383	7.7	10
4A	N	46½-49½	7-26-67	3118	374	7.2	290
4A	N	46½-49½	8- 2-67	3800	383	7.0	8
4A	CP	46½-49½	9-26-67	9265	389	7.4	8
4B	N	34½-37½	7-26-67	3117	398	7.2	60
4B	CP	34½-37½	8-30-67	7006	386	7.3	12
4C	N	20½-23½	7-26-67	3131	368	7.4	60
4C	CP	20½-23½	8-30-67	7005	398	7.3	neg.
5A	Poppet*	18½-21½	7-26-67	3120	2470	7.7	1000
5A	N	18½-21½	7-27-67	3137	2246	7.3	1500
5A	Poppet	18½-21½	8- 2-67	3807	2237	7.3	800

* N - compressed nitrogen used to force sample to surface; poppet - lifted from hole on pump piston.

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL - Continued							
70	920	17	1072	600	211	0	
3400	3280	26	1049	1130	323	neg.	
3000	3440	192	1149	620	589	0	
neg.	1300	1000	13	80	10	0.3	
neg.	930	460	87	205	83	0.8	
LANDFILL							
0	380	76	54	28		0.2	
0	328	6	39	9		0	
30	308	2	43	6	7.2	0.1	
35	348	14	31	9		0.7	
neg.	350	6.4	36	8	3.2	0.8	
35	408	40	53	29		1.7	
40	1010	650	431	500	4.2	1.6	
0	344	44	31	9		0.3	
20	332	34	28	10		0	
neg.	324	20	24	6	4.0	0.1	
0	332	28	27	9		0.5	
30	332	20	23	5	4.8	0.4	
35	272	18	35	16		0.3	
0	340	8	14	7		0.3	
neg.	320	0.4	26	6	19.2	0.2	
0	248	30	58	7		0.3	
neg.	308	6	35	6	4.4	0.2	
75	328	3	21	7		0.9	
20	324	5	27	7		0.2	
100	332	0.4	26	5	3.2	0.6	
0	348	4	23	11		0	
20	310	2	35	5	2.6	0.2	
35	348	6	9	7		0	
neg.	350	14	22	5	4.8	0.2	
3360	812	16	763			0	
330	844	10	645			0	
230	860	5	633			0	

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.		Sam- pling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
ELGIN								
LW	5B	Poppet	10½- 13½	7-26-67	3119	2570	7.4	1400
	5B	Poppet	10½- 13½	7-27-67	3136	2287	6.9	1700
	5B	CP	10½- 13½	8-30-67	7000	2470	6.8	992
	6A	PJ	38 - 41	7-26-67	3122	379	7.2	23
	6A	N	38 - 41	8- 2-67	3801	395	7.4	160
	6A	CP	38 - 41	9-27-67	9269	395	7.4	4
	6B	CP	18½- 21½	7-26-67	3121	1647	7.6	170
	6B	CP	18½- 21½	8-30-67	7002	1383	7.2	10
	7A	N	30 - 33	7-27-67	3127	374	7.5	230
	7A	N	30 - 33	8- 2-67	3802	371	7.4	40
	7A	CP	30 - 33	9-27-67	9268	365	7.5	12
	7B	N	22 - 25	7-27-67	3126	710	7.7	2600
	8A	CP	33½- 36½	7-27-67	3138	386	7.5	30
	8A	CP	33½- 36½	7-27-67	3135	359	7.4	15
	8A	CP	33½- 36½	9-27-67	9266	395	7.4	8
	8B	CP	15 - 18	7-27-67	3134	1123	7.3	70
	8B	CP	15 - 18	8-30-67	7001	1605	7.2	20
	9A	N	28 - 31	8- 2-67	3803	371	7.6	468
	9A	CP	28 - 31	9-27-67	9267	359	7.7	12
	9B	N	12 - 15	8- 2-67	3804	1262	7.7	472
	9B	CP	12 - 15	8-29-67	7007	2272	7.3	34
	9B	b	12 - 15	11-28-67	13454	1529	7.7	50
Well 1			?	9-15-67	8753	2129	7.9	417
	1		?	10-24-67	11279	1699	7.2	236
	2		?	9-15-67	8754	437	7.5	42
	2		?	10-24-67	11282	452	7.6	26
WOODSTOCK								
LW	1B	CP	31 - 34	9-13-67	8147	448	7.6	12
	1B	CP	31 - 34	11- 7-67	12153	449	7.2	0
	1C	b	22 - 25	9-13-67	8151	1003	7.6	85
	1C	CP	22 - 25	11- 7-67	12154	805	7.5	19
	1C	b	22 - 25	11-20-67	12986?	617	7.0	
	1D	b	11½- 14½	11- 7-67	12155?	6647	7.7	564
	1D	b	11½- 14½	11-20-67	12987	7265	8.2	

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
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LANDFILL - Continued

270	1140	60	658			0	
160	912	51	633			0	
260	1100	28	630	510	75	0	
75	352	4.0	12	7		0	
0	340	10	25	7		0	
neg.	332	5	29	5	8.8	0	
40	1420	1000	104	165		0.2	
neg.	1090	810	135	138	4.0	0.3	
0	316	8.2	27	9		0	
0	332	9	18	7		0.1	
neg.	316	0.4	23	5	10.4	0	
0	580	343	60	28		0	
20	348	13	17	7		0	
0	348	3	5	7		0	
neg.	324	0	33	5	6.4	0	
0	856	480	123	145		0.7	
neg.	1260	910	159	198	3.0	1.2	
0	360	44	5	15		0	
55	280	33	36	7	12.0	0	
0	788	487	218	198		0.4	
20	1390	1360	314	435	27.2	0.5	
neg.	670	542	395	290	95	0.3	
90	700	trace	657	655	12.8	neg.	
60	640	20	487	595	54	0	
neg.	360	7	35	59	0.8	neg.	
30	325	8	58	88	11	0	

LANDFILL

neg.	340	68	50	22	137.6?	0.4	
neg.	360	87	41	16	12.0	0	
75	420	28	268	190	39.6	?	Detergents, 2.0
neg.	320	31	223	135	22.4	0	
	366		115	80			
80	1000	345	2598	2370	34.4	0	
	1110		2831	2400			

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.		Sampling method	Screened interval (ft)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
WOODSTOCK								
LW	2A	AC	145 -148	10- 6-67	10148	346	8.1	4
	2B	AC	76 - 79	10- 6-67	10149	337	8.1	2
	2C	PJ	53½- 56½	8-10-67	6270	338	7.7	8
	2C	PJ	53½- 56½	8-11-67	5341	335	7.7	10
	2C	AC	53½- 56½	10- 6-67	11573	313	8.3	10
	2D	b	8½- 9	9-13-67	8143	377	7.7	0
	2E	CP	4½- 5	8-10-67	5334	371	7.4	4
	2E	b	4½- 5	11-20-67	12989	398	7.3	
	3A	AC	192 -195	10- 6-67	10150	404	7.9	98
	3B	AC	162 -165	10- 6-67	10151	404	8.1	0
	3C	N	101½-104½	9-13-67	8146	352	7.8	24
	3C	AC	101½-104½	10- 5-67	11571	354	7.4	12
	3D	CP	62 - 65	8-10-67	5339	452	7.5	12
	3D	CP	62 - 65	9-13-67	8150	490	8.1	4
	3D	AC	62 - 65	10- 5-67	11574	419	7.5	14
	3D	b	62 - 65	11-20-67	12988	472	7.4	
	3E	CP	19 - 22	9-13-67	8149	1583	7.5	129
	3F	b	7 - 7½	9-13-67	8145	1235	7.4	428
	3F	b	7 - 7½	11-20-67	12990	1314	7.1	
	4A	AC	118 -121	10- 6-67	10152	343	8.1	8
	4B	AC	102 -105	10- 6-67	10153	353	8.0	0
	4C	AC	70 - 73	10- 6-67	10154	353	7.9	2
	4C	b	70 - 73	11-20-67	12979	348	7.7	0
	4D	CP	26½- 29½	11- 7-67	12156	805	7.5	31
	4D	AC	26½- 29½	11-20-67	12980	583	8.3	0
	5A		44 - 47	8-11-67	5342	397	7.5	8
	5A		44 - 47	11-29-67	13451	404	8.0	34
	5B		18½- 21½	8-14-67	5340	407	7.3	6
	5B		18½- 21½	11-29-67	13452	427	7.7	26
	5C		9½- 10	8-14-67	5337	645	7.2	8
	5C		9½- 10	11-29-67	13455	775	7.7	28
	6A		31 - 34	8-11-67	5343	1129	7.0	81
	6A		31 - 34	11- 7-67	12158	1133	7.2	69
MM	6A		31 - 34	11-20-67	12978	935	7.7	58
	1	CP	7½- 8	8-14-67	5344	1545	6.8	59
	4	CP	18½- 19	0-13-67	8142	730	7.3	8

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL - Continued							
neg.	270	13	35	10	24	0.2	
neg.	260	12	35	7	6.8	0.2	
0	270	12	31	6	32.0	0	
0	270	14.0	30	5	13.9	0.2	
neg.	260	40	24	4	13.6	0	
neg.	272	64	48	13	19.2	0.5	
0	360	64	5	8	1.0	0	
	330		31	15			
neg.	330	1	34	6	1.1	0	
neg.	310	6	43	10	25	0.4	
neg.	300	2.4	24	15	123.2	0.6	
neg.	290	25	29	5	48.0	0.4	
20	390	14	29	2	1.4	0	
neg.	420	9.6	32	8	3.4	0.2	
neg.	400	18	8	4	1.3	0	
	395		35	10			
neg.	1010	14.8	264	155	24.8	0	
75	670	22	260	195	71.2	0	
	650		305	243			
neg.	250	7	43	15	48	0.2	
neg.	270	11	38	7	10	0	
neg.	280	46	34	8	1.8	0.3	
neg.	295	37	24	10	12	0.5	
neg.	480	175	150	65	4.8	0	
neg.	540	136	20	15	4.0	0.3	
0	350	14.0	22	4	1.2	0	
neg.	280	3	57	7	20	0	
0	360	66.0	22	19	3.1	0	
neg.	310	62	54	21	38	0.1	
0	500	190.0	67	80	3.7	0.4	
neg.	530	360	113	72	38	1.1	
0	770	28.0	165		5.9	0.2	
20	520	13	282	120	8.0	0	
neg.	520	7	191	113	17	0	
0	1160	233.3	177		12.2	0.2	
neg.	720	290	5	16	24.8	0.4	

TABLE 6 - CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER ASSOCIATED

Installation no.	Sam- pling method	Screened interval (ft.)	Date sampled	Lab. sample no.	Total solids (ppm)	pH	Chemical oxygen demand (ppm)
WOODSTOCK							
MM 4	AC	18½-19	11-20-67	12981	664	7.9	0
6	CP	6 - 6½	8-11-67	5338	416	7.3	4
6	AC	6 - 6½	11-20-67	12982	417	8.1	0
7	b	8½- 9	11- 7-67	12160	3823	7.4	108
7	b	8½- 9	11-20-67	12991	3743	7.1	
8	b	15 -15½	11- 7-67	12161	1492	7.2	61
8	b	15 -15½	11-20-67	12983	1342	7.9	4
9	b?	8½- 9	8-14-67	5335	638	7.4	51
9	b	8½- 9	11- 7-67	12162	695	7.1	61
9	b	8½- 9	11-20-67	12992	718	6.9	
10	b	8 - 8½	8-14-67	5336	524	6.8	39
10	b	8 - 8½	11-20-67	12984	583	7.3	31

QUALITY ANALYSES BY A COMMERCIAL LABORATORY

Table 7 shows a selection of more complete analyses run by Allied Laboratories, Chicago, Illinois. These samples were taken to the laboratory the day they were collected. Analytical methods used are from "Standard Methods for the Examination of Water and Waste Water" (American Public Health Association et al., 1965) and are listed below, with appropriate page references to that book.

pH - Glass electrode method (Beckman pH meter) - page 226

Iron - Tripyridine method - page 159

Bicarbonate ("M" alkalinity) - Titration with methyl orange - page 48

Chloride - Argentometric method - page 86

WITH LANDFILLS, BY THE STATE DEPARTMENT OF PUBLIC HEALTH - Continued

Org. acids (ppm)	Hardness (as CaCO ₃) (ppm)	Sulfate (ppm)	Sodium (est.) (ppm)	Chloride (ppm)	Iron (ppm)	Manga- nese (ppm)	Comments
LANDFILL - Continued							
neg.	625	235	18	9	17	0.3	
20	390	72.0	12	12	3.4	0.2	
neg.	375	76	19	11	14	0	
neg.	1550	2000	1046	728	33.6	0.1	
	1720		931	680			
neg.	900	500	272	278	53	0	
neg.	980	400	167	268	9.6	0.1	
0	500	136.0	64	15	2.5	0	
neg.	570	220	58	65	20	0.3	
	590		59	60			
0	470	56.0	25	5	15.2	1.1	
neg.	540	120	20	9	19	0.8	

Sulfate - Turbidimetric method - page 291

Calcium - EDTA titration - page 74

Magnesium (by difference between Ca and total hardness)

Total hardness - EDTA titration - page 147

Sodium and potassium (by difference between total hardness and total anions)

Total Kjeldahl nitrogen - page 404

Total nitrate-nitrite nitrogen - Phenoldisulfonic acid - page 195

Table 7 appears on the following pages.

TABLE 7 -- CHEMICAL ANALYSES OF LEACHATE AND GROUND WATER

Installation no.	Screened interval (ft)	Date sampled	pH	Iron (ppm)	Bicar- bonate (ppm)	Chlo- ride (ppm)	Sul- fate (ppm)	Cal- cium (ppm)
Woodstock								
MM 7	8½- 9	11-21-67	6.8	10.3	882	648	1250	170
MM 9	8½- 9	11-21-67	6.7	7.2	322	70	213	142
LW 1C	22 -25	11-21-67	6.9	17.0	468	94	8.2	67
LW 1C	22 -25	11-21-67	6.9	25.0	434	63	8.2	62
LW 1D	11½-14½	11-21-67	7.9	6.0	1410	2320	neg.	8.2
LW 2E	4½- 5	11-21-67	7.1	5.9	328	19	56	68
LW 3D	62 -65	11-21-67	7.1	1.4	422	12	8.2	48
LW 3F	7 - 7½	11-21-67	6.8	22.0	886	288	10	63
DuPage County								
MM 12	?	11-28-67	5.9	150	6070	1390	neg.	732
MM 39	10½-11	11-28-67	6.7	0.5	322	65	12	97
LW 2B	38 -41	11-28-67	6.9	0.4	395	12	26	62
LW 2B	38 -41	11-28-67	6.9	0.6	363	19	28	74
LW 4A	90 -93	11-28-67	7.3	0.8	328	24	18	53
LW 5A	47 -50	11-28-67	6.7	0.5	345	12	21	55
LW 5B	20 -23	11-28-67	5.9	450	6360	1650	neg.	830
LW 5C	13 -13½	11-28-67	6.2	330	6810	1710	1.6	595
Winnetka								
MM 6	5½- 6	12- 4-67	6.7	1.1	363	210	492	263
MM 10	4½- 5	12- 4-67	6.6	28.5	1970	687	3	68
LW 1E	12 -15	12- 4-67	6.8	17.5	3050	1320	25	315
LW 2A	121½-124½	12- 4-67	7.8	2.2	171	39	23	20
LW 8A	60 -63	12- 4-67	7.7	1.6	161	36	18	41
LW 8A	60 -63	12- 4-67	7.7	1.2	178	36	20	26
LW 9A	64 -66	12- 4-67	7.9	1.2	164	53	23	23
Elgin								
LW 3B	31½-34½	11-28-67	7.2	0.5	370	15	8	64
LW 1B	23 -26	11-28-67	7.0	0.6	404	17	8	72
LW 1C	7½-10½	11-28-67	7.0	1.1	515	266	131	116
LW 6A	38 -41	11-28-67	6.9	0.5	359	15	15	71
LW 6A	38 -41	11-28-67	6.8	0.5	363	12	8	75
LW 6B	18½-21½	11-28-67	6.8	0.6	448	126	377	134
LW 8A	33½-36½	11-28-67	7.0	0.3	397	12	7	77
LW 8B	15 -18	11-28-67	7.1	0.5	568	182	710	167

ASSOCIATED WITH LANDFILLS, BY A COMMERCIAL LABORATORY

Magne- sium (ppm)	Total hardness (as CaCO ₃) (ppm)	Sodium and potassium as Na (by diff.) (ppm)	Total Kjeldahl nitrogen (ppm)	Total nitrate- nitrite nitrogen (ppm)	Total dissolved solids, by conductivity (as NaCl) (ppm)
Landfill					
287	1610	686	1.8	1.4	3350
51	568	153	3.9	0.9	580
48	366	112	2.5	0.9	375
46	346	86	1.5	1.0	445
262	1100	1650	3.2	1.5	6850
36	318	44	1.8	0.9	310
66	393	26	3.0	0.7	275
50	363	432	1.5	0.6	1060
Landfill					
328	3180	2230	302	5.5	6840
51	452	42	2.2	0.7	340
40	318	57	4.0	1.7	325
47	380	18	4.2	1.0	325
47	328	24	0.5	1.2	210
39	291	40	2.0	0.9	240
299	3300	2480	711	11.2	7010
257	2550	3070	756	14.4	8560
Landfill					
85	1010	77	4.2	0.9	1030
169	868	958	193	1.4	2740
93	1170	1640	374	1.0	4280
13	106	66	2.5	0.6	205
10	144	40	2.8	1.0	205
7	92	72	4.3	1.2	205
16	123	65	1.3	1.2	220
Landfill					
46	352	21	3.0	1.2	188
40	346	42	5.8	0.7	240
76	606	194	5.5	1.0	940
36	328	31	2.3	1.4	220
32	321	31	1.5	0.5	220
104	766	116	1.6	0.3	630
33	328	42	2.5	0.7	240
154	1050	233	4.5	1.0	850

NEUTRON ACTIVATION ANALYSES

Neutron activation analyses were run by R. R. Ruch of the Illinois State Geological Survey on water samples from the studied fills on two occasions. The results of these analyses are listed in table 8.

The first samples were collected at the DuPage County landfill and analyzed in February 1967. When high bromine values were found in samples MM 2 and MM 29, we collected additional samples from all four fills in December 1967. At the suggestion of the U. S. Department of Public Health, selenium determinations were also made on these samples.

TABLE 8 - RESULTS OF NEUTRON ACTIVATION ANALYSES*

February 1967					
Sampling point	Br (ppm)	Na (ppm)	Cl (ppm)	Mn (ppm)	Comments
DuPage LW 3C	≤0.09	7.6	2.1	0.12	Interbedded sand
DuPage LW 2B	≤0.11	16	2.4	0.04	Interbedded sand
DuPage MM 2	6.2	187	262	≤0.01	Immediately south of fill in surficial sand
DuPage MM 29	13.6	875	1150	≤0.03	Below fill in surficial sand
December 1967					
Sampling point	Br (ppm)	Se (ppm)	Na/Br		Comments
Winnetka MM 10	3.6 [†]	<0.3	95		Point within refuse
Winnetka LW 1E	11		69		Point at base of refuse
Elgin LW 5B	3.6 [†]	<0.1	115		Sand and gravel below refuse
Elgin LW 1C	1.9		115		Surficial sand east of fill beside Fox River
Woodstock LW 1D	15 [†]	<0.3	128		Point in refuse
Woodstock LW 3E	0.5		340		Surficial sand immediately west of fill
DuPage LW 5B	8.2 [†]	<0.2	156		Surficial sand below fill
DuPage MM 12	4.0		188		Surficial sand immediately east of fill

* Irradiated for one hour in Triga reactor in January 1967. No long-lived radioactivity detected after two weeks.

† Average of duplicate runs. Estimated accuracy ± 25% relative value.

LANDFILL GASES

Gas from MM 30 at the DuPage County landfill was analyzed for CO₂ (27.3%), O₂ (0.2%), N₂ (1.0%), and methane (71.5%). Analysis results were similar to those of landfill gases from California (Engineering-Science Inc., 1965)[†] but had a higher methane content than is common in that area. The methane in the gas presents an explosion hazard. The presence of carbon dioxide will raise the ground-water hardness.

† "In Situ Investigation of Movements of Gases Produced from Decomposing Refuse": Ann. Rept. 3, Calif. Water Quality Control Board, Eng.-Sci. Inc., Arcadia, Calif.

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* Out of print

